Osteoarthritis and Cartilage 20 (2012) 1477–1483

Osteoarthritis and Cartilage

OARSI OSTEOARTHRITIS RESEARCH SOCIETY INTERNATIONAL

Review

Osteoarthritis 2012 year in review: rehabilitation and outcomes

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ARTICLE INFO

Article history:
Received 18 May 2012
Accepted 29 August 2012

Keywords:
Osteoarthritis
Knee
Hip
Rehabilitation
Outcome

SUMMARY

Recent scientific advances in the treatment of hip and knee osteoarthritis (OA) relating to education, exercise, weight control and passive non-pharmacological and non-surgical treatments such as manual therapy, orthoses/orthotics and other aids are described.

Methods: A systematic literature search was performed in Medline from July 2011 to 10 April 2012 using the terms 'osteoarthritis, knee', 'osteoarthritis, hip' rehabilitation, physical therapy, exercise therapy and preoperative intervention; both as text words and as MeSH terms where possible. Trials evaluating rehabilitation interventions were included if they were randomized controlled trials (RCTs) or systematic reviews. Outcome papers were identified by combining the initial search with the terms 'outcome', 'measure*', 'valid*', 'reliabil*' or 'responsiveness'. Outcome studies were included if they contributed methodologically to advancing outcome measurement.

Results: The literature search identified 550 potentially relevant papers. Seventeen RCTs on rehabilitation were selected and the results from these were supported by six systematic reviews. Sixteen outcomes papers were considered relevant, but did not add significantly to current knowledge about outcome measures in OA and so, were not included.

Conclusion: The current research focus on non-pharmacological and non-surgical treatments for hip and/or knee OA, when combined in systematic reviews, is improving the available evidence to identify best practice treatment. Education, exercise and weight loss are effective in the long term and supported as cost-effective first-line treatments.

Introduction

According to research evidence and expert opinion, osteoarthritis (OA) of the hip and knee is best managed by using education, exercise and weight control with the addition of passive treatments, including pharmacological and surgical interventions when needed[1], (Fig. 1).

This manuscript will describe recent scientific advances in the treatment of hip and knee OA relating to education, exercise, weight control and passive non-pharmacological and non-surgical treatments such as physiotherapy, orthoses/orthotics and other aids (the base of the pyramid in Fig. 1). These treatments can be used alone or in combination with pharmacological and surgical treatments.

Purpose

This review highlights seminal publications of rehabilitation and outcomes in hip and/or knee OA between July 2011 and April 2012.

Methods

A systematic literature search was performed in Medline from July 2011 to 10 April 2012 using the terms 'osteoarthritis, knee', 'osteoarthritis, hip' rehabilitation, physical therapy, exercise therapy and preoperative intervention; both as text words and as MeSH terms where possible. Trials were eligible if the majority of the included patients had OA, stated by the authors as either clinically or radiographically diagnosed. Trials of patients with chronic knee joint pain were included as it is the main clinical diagnostic criteria for knee OA. Trials evaluating rehabilitation interventions were included if they were randomized controlled trials (RCTs) or systematic reviews. Surgical interventions and pharmacology studies were excluded unless they included evaluation of a rehabilitation intervention, either as a comparison group or where the additional effect of exercise over and above the pharmacological or

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1063-4584/$ – see front matter
http://dx.doi.org/10.1016/j.joca.2012.08.028

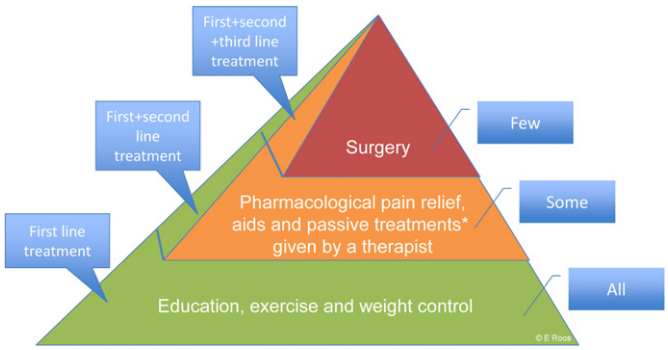

Fig. 1. The OA treatment pyramid. OA of the hip and knee is best managed using education, exercise and weight control with the addition of pharmacological and surgical interventions when needed. All patients should be offered first-line treatment, while some will need second line treatment and few will need third line treatment. *Passive treatments include manual therapy, acupuncture, and other treatments given by a therapist and not requiring an active lifestyle change by the patient.

surgical intervention was assessed. Outcome papers were identified by combining the initial search with the terms 'outcome', 'measure*', 'valid*', 'reliabil*' or 'responsiveness'. Outcome studies were included if they contributed methodologically to advancing outcome measurement. One of the authors (CJ) scrutinized titles and abstracts of all identified trials. The full text of any article was obtained if it was judged to be potentially eligible. Both reviewers then evaluated eligibility based on the full text of all the retrieved papers, and consensus on inclusion was reached by discussion. Additionally, a few non-randomized studies adding significantly to the areas identified are highlighted.

Results

Systematic review

The literature search identified 550 potentially relevant papers. Seventeen RCTs on rehabilitation were selected and the results from these were supported by six systematic reviews. Sixteen outcomes papers were considered relevant (Table I), but did not

Table I
Sixteen outcomes papers considered relevant but not included in this review

Author	Purpose	Conclusion
Bilbao (2011)[27]	Propose a Spanish WOMAC short form and study its validity, reliability, and responsiveness	The Spanish WOMAC short form is valid, reliable, and responsive for hip OA
Elbaz (2011)[28]	Examine the associations of sex, body mass index (BMI), and age with outcomes in knee OA	Patients with higher BMI and women are at a greater risk for worse symptoms (WOMAC and SF-36)
Feinglass (2012)[29]	Analyze change in accelerometer-measured physical activity for participants with arthritis	Participants at a higher risk of mobility loss may be more committed to improve lifestyle physical activity
French (2011)[30]	Compare the responsiveness of two self-report measures and three physical performance measures of function following physiotherapy	Six-minute walk test (6MWT) was more responsive than timed-up-and-go test (TUGT), timed-stand test (TST). Lequesne Algofunctional Index (LAI) was more responsive than the WOMAC total score and the WOMAC subscale physical function
Jans (2011)[31]	Examine the reproducibility, construct validity, and unidimensionality of the Dutch translation of the de Morton Mobility Index (DEMMI)	The Dutch translation of the DEMMI is a re-producible and valid performance-based measure for assessing mobility in older patients with knee or hip OA
Kapreli (2011)[32]	Adapt and validate the Greek version of Knee Outcome Survey–Activities of Daily Living Scale (KOS–ADLS)	The Greek version of KOS–ADLS was found to be reliable, valid, responsive and comprehensible for use in patients with knee pathology
Khanna (2011)[33]	Determine whether patients could reliably assess their outcome with use of a American Knee Society Score and Oxford Knee Score questionnaires and self-reported knee range of motion	Patients' self-reported American Knee Society pain and function sub-scores were worse than the corresponding clinician assessments, but the Oxford Knee Scores were similar
Lee (2011)[34]	Translate and culturally adapt the HOOS questionnaire for use in Korean and to test the psychometric properties	The Korean version of HOOS showed satisfactory internal consistency, test–retest reliability, convergent validity, and responsiveness
Martinelli (2011)[35]	Translate the Oxford Hip Score (OHS) into Italian and to evaluate the psychometric properties	The Italian OHS questionnaire is valid, reliable, and responsive for use in Italian patients with symptomatic hip OA
McQuade (2011)[36]	Determine if increasing strength in primarily knee extensors and flexors affects net knee joint moments during step up	Improvements in function, pain, and other symptoms, as a result of strength training, may not be causally related to specific biomechanical changes in net joint moments
Nakamura (2011)[37]	Provide a cross-culturally adapted and validated KOOS questionnaire for use in Japan	Japanese KOOS is a valid, reliable and stable outcomes measure in knee OA
Peixoto (2011)[38]	Analyze the relationships between measures of muscular performance, proprioceptive acuity and age	No significant relationships between measures of proprioceptive acuity and muscular performance of the quadriceps and hamstring muscles
Pua (2011)[39]	Evaluate the cross-sectional associations of knee extensor strength, standing balance, and their interaction with physical function	Standing balance was related to physical function, but this relationship was complex and dependent on knee extensor strength level
Semanik (2011)[40]	Evaluate the correlation between the Yale Physical Activity Survey (YPAS) scores and objective accelerometer measures of time spent on physical activity	Weak correlations (0.31–0.36) between the YPAS scores and objective accelerometry
Senden (2011)[41]	Investigate the suitability of Acceleration-based gait analysis (AGA) for measuring function in patients with gonarthrosis	AGA was found to be of clinical relevance in identifying and monitoring patients with symptomatic gonarthrosis in orthopaedic practice
Sorensen (2011)[42]	Investigate the relationship between quadriceps force steadiness and KAM during walking in patients with knee OA	No statistically significant association between submaximal isometric quadriceps force steadiness and peak knee external adduction moments during walking was found

add significantly to current knowledge about outcomes in OA and so, were not included.

Exercise is cost-effectiveness

For patients suffering from hip and/or knee OA, the current treatment guidelines recommend exercise and education. Although these treatments have been found to be effective, there is limited evidence of their cost-effectiveness.

Pinto *et al.*[2] identified 11 studies for inclusion in a meta-analysis investigating the cost-effectiveness of first-line treatments in patients with hip and knee OA. Of these, 10 involved economic evaluations and one reported health-care costs in an RCT. In the course of that review, most of the RCTs were found to demonstrate a high risk of bias for the cost and/or effect elements of their cost-effectiveness estimate. Where exercise interventions were evaluated, they were found to be cost-saving.

Exercise programs appear to offer the best value for money for first-line management of hip and/or knee OA, particularly where outcomes based on quality-adjusted life year (QALY) are used as the measure of benefit[2]. This was supported by a large RCT published by **Hurley *et al.***[3], which reported that exercise and self-management for 6 weeks only had a high probability (80–100%) of being cost-effective at 30 months. Four hundred and eighteen patients with chronic knee pain met the inclusion criteria and were assigned to either the exercise and self-management group or the control group (usual care). At 30-month follow-up, the costs associated with community-based health care, medication and total health and social care were significantly lower for the exercise and self-management group than the control group.

The finding that exercise and self-management is not only effective but also cost-effective will help the implementation of guidelines for the delivery of clinical care. Establishing the economic efficiency of first-line interventions is essential if clinicians are to make informed decisions about the optimal utilization of resources for the treatment of hip or knee OA.

New tools for implementation of clinical guidelines, decision-making and education

The recent increasing focus on care strategies, decision-making instruments and patient education in OA treatment was highlighted in some studies.

Smink *et al.*[4] employed a consensus approach to develop an evidence-based, multidisciplinary, patient-centred, stepped care strategy in order to support the implementation of clinical guidelines and improve the delivery of non-surgical treatment options for patients with hip or knee OA. The care strategy offers clinicians and patients a structure for discussing the optimal timing of the different treatment alternatives. The outcomes of this study constitute an important step towards improving implementation of evidence-based guidelines in OA.

Regarding total joint replacement as a treatment option, a study of 208 patients with knee OA found that a patient decision aid on OA management in the form of a videobooklet was more effective at reducing patient indecision than either printed information on its own or when supplemented by a more complex computer-based instrument[5]. These findings emphasize the importance of the information delivery mode to facilitate informed decision-making.

A feasibility study provided proof of principle for testing The Hip & Knee Book in a larger definitive RCT[6]. Williams *et al.* had previously[7] identified six sets of evidence-based guidelines and 54 systematic reviews that were used to produce a draft patient-centred booklet for people with hip or knee OA, offering information and advice on how best to maintain activity. Focus groups then discussed and evaluated the draft. During the focus groups, many participants expressed confusion about the cause of OA, and were surprised to hear that it was possible that their pain might improve. They acknowledged the benefits of exercise and weight loss but found it difficult to accept that heavy physical activity could be causative, while moderate exercise could be beneficial. Fear of dependency on analgesic medications and misunderstanding of information about hyaluranon injections were also evident. The information on joint replacement gave patients more confidence to discuss referral with their general practice. The booklet was modified to reflect the input from the focus groups. Enhancing evidence-based messages with patient-centred messages will help clinicians to communicate best practice treatments to patients.

Weight loss affects muscle mass, hormones and has long-term effects

Obesity is one of the most important risk factors in the development of knee OA. A single high quality RCT involving obese patients with knee OA and an average age of 63 years found continuous reinforcement of an intensive low-energy-diet induced weight loss and reduced pain over the course of 1 year[8]. These findings are important since they show that it is possible to maintain weight loss over a sustained period of time.

A separate paper from the same study reported that weight loss induced by a low-energy-diet led to reductions in both leg muscle tissue and absolute knee muscle strength. On average, total body and leg lean mass were decreased by approximately 4%. The results underline the importance of implementing an exercise regime to restore, or better still, improve muscle mass in knee OA patients while they are undertaking a weight loss program[9].

A report from the Arthritis, Diet, and Activity Promotion Trial found that weight loss in obese women with knee OA was accompanied by an increase in basal growth hormone concentration. This suggests that the effects from weight loss seen in these patients may reduce the effects of age- and obesity-related decreases in hormone levels and help maintain physical function, strength and muscle mass in older adults[10].

Exercise as treatment for OA

Given the positive effects of exercise in patients with mild and moderate knee OA, it was not surprising to find the largest number of studies identified in the systematic search related to this intervention. There is a high level of evidence supporting the benefits of exercise in mild and moderate knee OA (and so far, to a lesser extent in hip OA) but the effect of exercise in patients with severe OA is less clear.

Exercise in severe hip and knee OA

Patients prior to total joint replacement have severe OA and therefore constitute a good model for studying the effect of exercise in patients with severe OA. A systematic review and meta-analysis conducted by **Wallis and Taylor**[11] reported low to moderate evidence that patients with hip and knee OA experience a reduction in pain prior to joint replacement, based on 23 mostly small RCTs assessing the value of preoperative interventions and exercise in particular. They also reported that exercise supplemented by education programs may improve activity after hip replacement.

The pain reduction is moderate, effect size 0.43, but comparable to what is seen following 12 or more sessions of exercise in patients with mild and moderate knee OA[12]. This suggests that patients of all stages of knee OA benefit from exercise but large high quality studies are needed to strengthen this evidence.

The effects of different types of exercise

Other studies investigating the effects of exercise on people with knee and/or hip OA added valuable information on various treatment effects such as type of exercise (balance, walking, water-based *versus* land-based, strength training with elastic bands, high-speed power training, or neuromuscular training). These studies are important as they contribute to our understanding of how to prescribe and individualize exercise to patients with OA. Some of these studies are outlined below.

A systematic search by **Silva *et al.***[13] for exercise studies involving women with knee OA where balance was an outcome identified nine RCTS, eight of which were considered high quality trials. Although there was wide variation in the methods and interventions used in these studies, most reported significant improvement in the balance of women with knee OA following therapeutic exercise. Since the methodological quality of the included studies was high, it can be concluded that exercise does improve the balance of women with knee OA, highlighting balance as one of the impairments that can be successfully addressed with exercise.

In an RCT designed to compare the efficacy of land-based with aquatic exercises in knee OA patients ($n = 84$) recruited from local community centres, **Wang *et al.***[14] reported similar positive outcomes from both interventions. The duration of exercise in both groups was 60 min, performed three times a week over a 12-week period. Both interventions were effective in reducing pain, improving function and knee-related quality of life. Despite beliefs to the contrary, the aquatic exercise was not found to be superior to land-based exercise in reducing pain. This study supports previous findings and strengthens the evidence that clinicians may recommend either well-structured aquatic or land-based exercise programs for OA patients, depending upon factors such as preference and convenience.

For the first time, high-speed power training and its impact on functional measures and pain were examined in a pilot study including 33 older adults with knee OA[15]. Twelve weeks of either high-speed power training or slow-speed strength training improved strength similarly in older adults with knee OA, but muscle power demonstrated greater improvement with high-speed training. Only high-speed power training improved muscle speed, which could have significant implications for safety in this population, particularly in situations where high-speed actions are required for activities of daily living. Despite improvements in muscle performance with high-speed power training, these improvements did not necessarily translate into improved function. Some measures of function and pain did improve with high-speed power training but no more than that of slow-speed strength training or the control intervention. This study is a good example of the principle of exercise specificity, which means, exercising a specific function primarily improves that function and that improvement does not necessarily carry over to other activities. This is an area receiving increasing attention within the field of OA treatment, as initially the same general exercise was recommended for OA patients as was being recommended to everyone, without specific consideration being given to such factors as the mechanics of the arthritic joint. For this reason neuromuscular exercise building on biomechanical and neuromuscular principles is attracting increasing interest as prevention and treatment of OA.

The impressive RCT conducted by **Hurley *et al.***[3] previously mentioned, not only documents the cost-effectiveness of exercise-based programs for patients with knee OA, but also reports on the long-term physical effects of a relatively short, simple exercise-based rehabilitation program (12 physiotherapist supervised twice weekly for 6 weeks). That program was called Enabling Self-Management and Coping of Arthritic Knee Pain Through Exercise (ESCAPE). Recruited from 54 primary care clinics, 418 people with chronic knee pain were randomized to either the ESCAPE program or to the control group (usual care). Improvement in physical function declined over time, but even 2.5 years after completing the ESCAPE program, participants still had clinically meaningful improvements in Western Ontario and McMaster Osteoarthritis Index (WOMAC) function at all assessment points compared with those who had had usual care. Immediately after the program, the number needed to treat (NNT) was calculated at 3.7. This means that for one person to improve at a clinically meaningful level or more compared to usual care, approximately four patients needed to be treated with the ESCAPE program. At 2.5 years, the NNT was 6.7, indicating a slight loss of that effect in the longer term. This large pragmatic RCT provides valuable insights into the implementation of exercise and self-help programs in primary care settings. As well as being relatively straightforward to execute, the program was both effective and cost-effective, even 30 months after completion of the intervention. This program could be readily adopted into clinical practice, thereby providing effective and efficient care for people with OA and chronic joint pain.

Other treatments in addition to exercise

In addition to exercise, no effect of glucosamine sulphate

A combination of exercise and glucosamine sulphate is one of the most commonly recommended treatments for patients with knee OA. In a recent study[16], 37 women diagnosed with knee OA were randomized into two groups: one where they participated in a 12-week strength training program, and the other where they received glucosamine sulphate (1500 mg/day) in addition to participating in the same exercise program. The exercise therapy was made up of active range-of-motion exercises, muscle stretching and flexibility exercises, and isometric and isotonic muscle strengthening exercises. Both groups showed improvements in a variety of outcomes including WOMAC pain, WOMAC physical function, muscle strength, walking distance, and leptin levels, but there was no significant difference between the groups. These results suggest that taking glucosamine sulphate does not add to the effects seen from exercise.

In addition to strength training, glucosamine and nonsteroidal anti-inflammatory drugs (NSAIDs) are associated with statistically, but not clinically, significant increases in strength compared to placebo

To examine the effect of strength training in combination with either glucosamine or NSAIDs, **Petersen *et al.***[17] recruited 36 patients with bilateral tibiofemoral knee OA and randomized them to three groups: glucosamine ($n = 12$), ibuprofen ($n = 12$), or placebo ($n = 12$). They all underwent a 12-week program of unilateral progressive strength training for both legs, with a focus on the quadriceps muscle. Training was carried out three times weekly, each session lasting 45 min, with a minimum requirement of attendance at 30 sessions. There were no differences observed in gains in muscle cross-sectional area between the three groups. Training supplemented with glucosamine increased maximal concentric muscle work in comparison with the placebo. The combination of training and NSAID increased maximal isometric strength, maximal eccentric muscle strength and eccentric muscle work in comparison with the placebo. The benefits observed were not considered large enough to justify taking glucosamine or NSAIDs.

From a clinical perspective, where NSAIDs or glucosamine are used by OA patients, they should be advised that taking NSAIDs or glucosamine while exercising will not decrease the effects from exercise.

In addition to exercise, targeted manual and manipulative therapy (MMT) is as good as full kinematic chain MMT

As an alternative to drugs, MMT in combination with exercise, is becoming more commonly used by musculoskeletal practitioners to treat symptoms of mild to moderate hip and knee OA. As early as a decade ago, **Hoeksma *et al.***[18] applied a combination of MMT and exercise therapy to treat hip OA, and reported that it was superior to exercise therapy alone.

Brantingham *et al.*[19] expanded on the work of Hoeksma *et al.* and others and studied the effect of MMT when applied to more than one joint. At the discretion of the clinician, full kinematic chain MMT was not only applied to the affected hip, but also to the low back, knee and foot on the same side. This full kinematic chain MMT plus exercise *versus* targeted hip MMT plus exercise were compared in a parallel-group randomized trial of patients with symptomatic hip OA ($n = 111$). Participants in both treatment groups received nine treatments over a period of 5 weeks by 13 unblinded senior chiropractic interns, under the supervision of three experienced chiropractors. The study did not include a group undertaking exercise only. There were no statistically significant differences in self-reported pain and function scores (WOMAC and Harris Hip Score) when comparing manual therapy of the hip only to manual therapy directed to more joints. The results of this study provide guidance to musculoskeletal practitioners who use MMT that the full kinematic chain approach does not appear to have any additional benefit over and above treatment targeted to a single joint.

In addition to exercise, no effects from whole-body vibration

Whole-body vibration has recently emerged as a possible alternative for muscle strength training and for poor balance. One prospective randomized trial involving 23 elderly patients with knee OA found that when whole-body vibration was added to squat training, it failed to result in any significant improvement in functional performance over and above that of squat training alone[20].

Passive treatments, aids

No effect of a realigning brace for patellofemoral OA

Malalignment in patellofemoral OA can cause abnormal dispersion in the patellofemoral joint reaction forces and increase pain and/or structural damage. Braces are used to improve patellar alignment and are thought to reduce pain and disability.

In an RCT with a cross-over design, Hunter *et al.*[21] investigated the efficacy of a realigning patellofemoral brace among people with symptomatic lateral patellofemoral OA. Eighty participants were randomized to either active treatment consisting of a realigning BioSkin Q Brace or to the same brace with the strap removed. The patients were asked to wear the assigned knee brace for a minimum of 4 h per day during the treatment period. The first intervention period was 6 weeks followed by a 6-week washout period before crossing over to the other treatment for the second 6-week period. No statistically or clinically significant treatment effect was found for the realigning PF brace on Visual Analog Scale (VAS) pain and the WOMAC subscales (pain, stiffness and physical function)[21].

A cane can be used to lessen leg pain

Canes are used to reduce the biomechanical load on the joints of the lower limb in patients with knee OA. This strategy is expected to increase both independence and tolerance to exercise, allowing a more efficient gait, with less joint stress.

To assess the impact of cane use, **Jones *et al.***[22] randomized 64 patients with knee OA to either daily cane use during gait over a 2-month period, or to a control group. The effect in relation to pain (VAS), physical function (WOMAC and Lequesne), general health Short Form 36 (SF-36) and energy expenditure (VO_2) was assessed. A cane can be used to lessen leg pain, improve physical function and enhance some aspects of quality of life in patients with knee OA, but the effect size is small, ranging from 0.07 (WOMAC subscale physical functioning) to 0.18 (VAS pain). The energy expenditure increases significantly with an effect size of 0.21. When recommending usage of a cane, the substantial increase in energy expenditure in the first month of use should be taken into account. Thereafter, this declines with adaptation to cane use.

Variable-stiffness shoes may lessen knee joint load

The aim of load-modifying interventions such as variable-stiffness shoes is to reduce the biomechanical load on the joints of the lower limb in patients with knee OA, especially the medial compartment, in order to reduce the knee adduction moment (KAM).

Erhart-Hledik *et al.*[23] reported the 12-month follow-up results of the effect of variable-stiffness shoes compared to constant-stiffness shoes (control) on knee joint load (KAM) and self-reported pain. Seventy-nine patients with a mean age of 60 years were enrolled. Even though all patients had persistent medial compartment knee joint pain and osteoarthritic change on magnetic resonance imaging, six patients in the intervention group had a Kellgren–Lawrence (KL) score of 0. No group differences were seen in total WOMAC and WOMAC subscale pain at 12 months. Using an intention-to-treat analysis, the variable-stiffness shoes reduced the within-day peak KAM (-5.5%, $P < 0.001$) in the intervention group, while the constant-stiffness shoes increased the peak KAM in the control group ($+3.1\%$, $P < 0.015$). *Post hoc* analysis stratifying on $KL \leq 2$ and $KL > 2$ showed a greater efficacy in KAM reduction in the less severe intervention group. In conclusion, wearing variable-stiffness shoes seems to reduce within-day KAM after long-term wear, and thus shows promise in reducing loading on the affected medial compartment of the knee, especially in early medial compartment OA.

No firm conclusions about Moxibustion (warm acupuncture)

Moxibustion is sometimes used in the management of rheumatic conditions such as knee OA and rheumatoid arthritis. However, a recent systematic review was unable to demonstrate conclusive evidence for its efficacy compared with drug therapy. Separate analysis for knee OA was presented. As the number of included trials and their methodological quality were low, it was difficult to draw firm conclusions about the effect of moxibustion in rheumatic diseases and OA in particular[24].

Patient characteristics impact the effects from acupuncture

Acupuncture has been investigated in a secondary analysis of 9990 patients suffering from one or more of four chronic pain problems, including hip or knee OA, who had participated in four multicenter, randomized, controlled studies. Patient with hip and knee OA were analyzed separately. Routine care with and without the addition of acupuncture was compared. **Witt *et al.***[25] found that duration of illness, baseline pain, age, education, and some coexistent diseases predicted treatment outcome in both groups. A number of patient characteristics were observed to increase the effect of the acupuncture: including female gender, failure of other treatments prior to the study, and previous positive acupuncture experience.

Surprising findings by shortwave therapy

Shortwave therapy is another therapist-dependent passive treatment for knee OA. It involves electromagnetic radiation applied by a shortwave device in either continuous or pulsed form.

Pulsed shortwave therapy is sometimes preferred over conventional, continuous applications because it minimizes the thermal effects while increasing the effects of incremental cellular trophism and metabolism. Pulsed shortwave therapy treatment is believed to reduce oedema and inflammation and increase local cellular activity, improve fibrin and collagen deposition, and improve tissue regeneration.

An RCT conducted by **Fukuda *et al.***[26] of 121 women with knee OA with a mean age of 60, found pulsed shortwave treatment administered three times a week over a duration of 3 weeks was an effective method for relieving pain and improving physical function and quality of life in the short term compared to sham shortwave and control. The effects on both short and long term far exceed results of other trials investigating shortwave. However, only per protocol analyses were provided which is cause for concern.

Summary and conclusion

The research domain of rehabilitation for people suffering from knee and/or hip OA is attracting increasing interest. For example, there have been approximately 550 publications in a 9-month period. This research is maturing, as seen by longer-term follow-ups, more systematic reviews and meta-analyses, and economic evaluations to quantify the efficacy of various OA treatments.

The current research focus on non-pharmacological and non-surgical treatments for hip and/or knee OA, when combined in meta-analyses, is improving the available evidence to identify best practice treatment. Education, exercise and weight loss are supported by both research evidence and expert opinion as preferred first-line treatments, and as adjunctive treatments prior to surgery. The promising results from this research focus may not only improve the quality of life of those suffering from hip and knee OA but also substantially reduce the cost burden on society.

Contributions

Juhl performed the literature search, reviewed the literature, drafted parts of the manuscript and provided intellectual input on the full manuscript.

Roos reviewed the literature, interpreted the data, drafted most of the manuscript, and provided intellectual input on the full manuscript.

Role of funding source

None.

Conflicts of interest

None.

Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.joca.2012.08.028.

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